PATENT SPECIFICATION

514,267

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PROVISIONAL SPECIFICATION

Improvements in or relating to Fire-resisting Casings for Beams and Columns in Structures

We, VICTOR LEFEBURE, ARTHUR HENRY DOUGLAS, both British subjects, and IMPERIAL CHEMICAL INDUSTRIES LIMITED, a British Company, all of Imperial Chemical House, Millbank, London, S.W.1. do hereby declare the nature of this invention to be as follows:—

It is well known that methods of protection are employed to enable columns or beams in structures to retain their strength in a fire by surrounding them with materials which resist the spread of heat from the exposed faces to the structural members, say steel columns. A common method is to build a column of concrete round the structural member, by the usual method of pouring concrete with the support of shuttering.

Attempts have been made to employ swifter, lower cost and drier methods by erecting narrow block walls round the structural member, thus attempting to use the air-space between such walls and the member as a contribution to the thermal resistance. Such methods are deficient owing to the tendency for the protecting walls, and notably the mortar, to crack, thus allowing flame and hot gases to penetrate beyond the wall and to contact with the member.

According to our invention we first surround the member to be protected with a layer of fire-proof board, such as wallboard or plaster board, consisting of a core of a calcium sulphate plaster between coverings or liners of paper, cardboard, pulp board or the like which are firmly bonded to the core. This can be shaped to fit round the member, or simply employed as long vertical strips of board. A preferred form consists of two **U**-shaped sections. These strips or sections are tied to or around the member by means of metal wire or metal ribbon, or other suitable forms of easy attachment. Alternatively, they can be stuck to the member by means of a fire-proof adhesive such as a composition of Portland cement, an alkaline silicate and a retarder such as glue. This method has the advantage of protecting the metal against corrosion. Metal clips can be employed to hold the strips or sections in position.

Thus an air-space round the member is provided, and a rigid backing for the blocks which follow. Blocks are now erected around the structure using a bonding material such as mortar or plaster, or a fire-proof adhesive such as that mentioned above. We prefer to employ metal strip or similar reinforcement in the bonding material. As the blocks are erected they are not only bonded together, but also bonded to the rigid sheet backing.

We prefer to employ blocks of void or cellular structure made from plaster of the accelerated anhydrite type or of plaster of Paris or the like. Such blocks can be made from plaster mixes containing foam or suitable gas generating agents, e.g. as described in Specification 385,611.

The fire-proof board is preferably a plaster-board with at least one face composed of a liner which contains asbestos fibre as part of the paper-making fibres as described in Specification 462,829. In this way we obtain a fire-resisting junction between the mortar and the core of the plasterboard, thus increasing the stability of the system when subjected to heat. As a mortar to bond the blocks and to stick them to the rigid backing, we prefer one of the calcium sulphate plaster type, say anhydrite plaster or hemihydrate.

Instead of using blocks we may surround the encased member with plaster or the like cast *in situ*. Thus the plasterboard next to the member to be protected may be used as shuttering in order to pour calcium sulphate protecting material, using a temporary or permanent outer shuttering, which outer shuttering can be of the same type of board. If it is to be permanent, we prefer to employ the board with at least one liner containing asbestos, this liner contacting with the inner, poured calcium sulphate material. If we wish we can employ this type of board as an outer liner for the system in which blocks are used instead of poured material as the main fire-resisting element.

We find that by employing the above

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Price 4s 6d

or channel form and placed around the member to be protected. The corners may be reinforced, if desired, with strips of linen, or cotton, or other suitable textile material.

It is advantageous to employ plaster board at least one liner of which contains asbestos fibre as part of the paper-making fibres, as described in Specification 462,829, or plaster board one liner of which is perforated so as to expose the plaster core at a number of places and thereby furnish a key for subsequently applied plaster. In this way a fire-resisting junction between the plaster and the core of the plaster board is obtained, which increases the stability of the system when subjected to heat.

The strips or sections forming the inner casing are tied to or around the member to be protected by means of metal wire or metal ribbon, or other suitable forms of easy attachment. Alternatively, they can be stuck to the member by means of a fire-proof adhesive such as a composition of Portland cement, an alkaline silicate and a substance such as glue which retards the set of the composition. This method has the advantage of protecting the metal against corrosion. Metal clips can be employed to hold the strips or sections in position.

Blocks may now be erected around the structure using a bonding material such as a plaster, or a fire-proof adhesive such as that mentioned above. We prefer to employ metal strip or similar reinforcement in the bonding material. As the blocks are erected they are not only bonded together, but also bonded to the inner casing.

We prefer to employ blocks of void or cellular structure made from plaster of the accelerated anhydrite type or of plaster of Paris. Such blocks can be made from plaster mixes containing foam or suitable gas generating agents, e.g. as described in Specification 385,611. The blocks may be reinforced internally and/or externally with paper or pulp board, e.g. as described in Specification 484,166. The blocks should be at least 1½ inches thick so as to produce a temperature gradient such that the temperature on the cold side is below the dehydration temperature of gypsum. As a bonding material to bond the blocks and to stick them to the inner casing, we prefer to use a calcium sulphate plaster, say anhydrite plaster or a hemihydrate plaster.

Instead of using blocks we may surround the encased member with plaster cast *in situ*. Thus the plaster board next to the member to be protected may be used as shuttering in order to pour calcium sulphate protecting material, using a temporary or permanent outer shuttering, which outer shuttering can be of the same type of board. If it is to be permanent, we prefer to employ the board with at least one liner containing asbestos, this liner contacting with the inner, poured calcium sulphate material. If we wish we can employ this type of board as a further outer casing for the system in which blocks are used instead of poured material as the main fire resisting element.

We find that by employing the above system, marked advantages are obtained as regards the fire-resisting effect for a given thickness, weight and cost of the protecting medium such as blocks.

In the accompanying drawings Figures 1 and 2 are broken perspective views of portions of columns encased according to the invention, and Figure 3 is a graph showing time-temperature curves for various points in the structure of Example 1 below, when subjected to a fire test.

Referring to Figure 1, the steel column 1 is surrounded by a box 2 of plaster board which has been made from a single wide sheet scored longitudinally and bent so as to break the plaster and leave the inner liner intact. The plaster board is strapped round the column at intervals by metal ribbon (not shown), and cellular anhydrite blocks 3 are then stuck to the plaster board 2 by a layer 4 of anhydrite plaster extending over the whole of the inner surface of the blocks 3. The joints between the edges of the blocks and the inner faces of the adjoining blocks are also bonded as shown. Referring to Figure 2, the steel column 15 is surrounded by a layer 6 of wire netting. Over this is wrapped a layer 7 of thick paper of the kind used in the manufacture of wallboard, and then a further layer 8 of wire netting, which is strapped round the column at intervals by metal ribbon (not shown). The blocks 9 are bonded to the wire netting base and to one another by anhydrite plaster as in the construction of Figure 1.

The following examples illustrate methods of carrying out the invention and the fire-resistant properties of the structures.

EXAMPLE 1.

An encasement was prepared as follows. ⅜" Gypsum plaster board of the type known as base board was strapped to the steel column to be protected by means of ⅜" steel ribbon spaced at intervals of 18". The column was a 5' × 6" × 5" standard I section. 2½" thick cellular anhydrite blocks were struck to the base board with anhydrite plaster and were reinforced at

junction with reinforcement, e.g. wire netting.

7. A fire-resisting casing according to any of Claims 1 to 6, in which the outer casing consists of blocks bonded together and to the inner casing.

8. A fire-resisting casing according to Claim 7, in which the blocks are of void or cellular structure and are made from anhydrite plaster or plaster of Paris.

9. A fire-resisting casing according to Claim 7 or 8, in which the bonding material consists of a calcium sulphate plaster, e.g. anhydrite plaster or a hemihydrate plaster.

10. A fire-resisting casing according to Claim 7, 8 or 9, in which metal strip or similar reinforcing material is provided in the bonding material.

11. A fire-resisting casing according to any of Claims 1 to 6, in which the outer casing consists of plaster cast *in situ*.

12. A fire-resisting casing according to any of Claims 1 to 11, in which a further outer casing, consisting of plaster board, is bonded to the outer casing of gypsum.

13. Fire-resisting casings substantially as hereinbefore described with reference to each of the foregoing examples, and Figures 1 and 2 of the accompanying drawings.

Dated the 28th day of April, 1939.

E. A. BINGEN,
Solicitor for the Applicants.

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SHEET 1

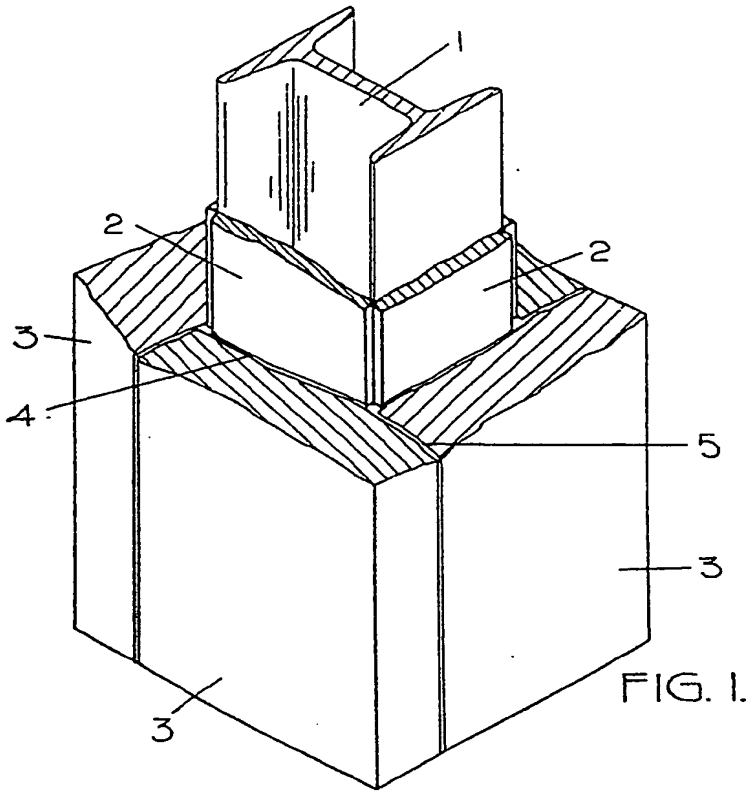

FIG. 1.

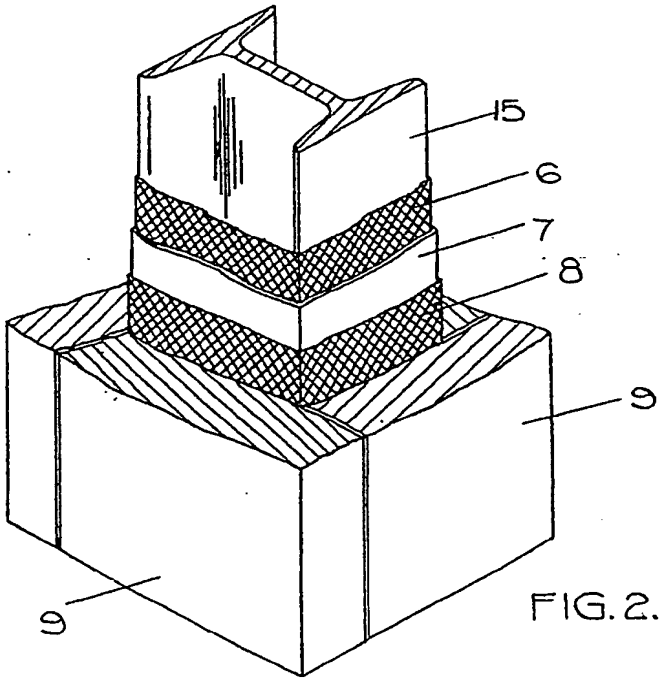

FIG. 2.

[This Drawing is a reproduction of the Original on a reduced scale.]

Temperature in degrees Centigrade

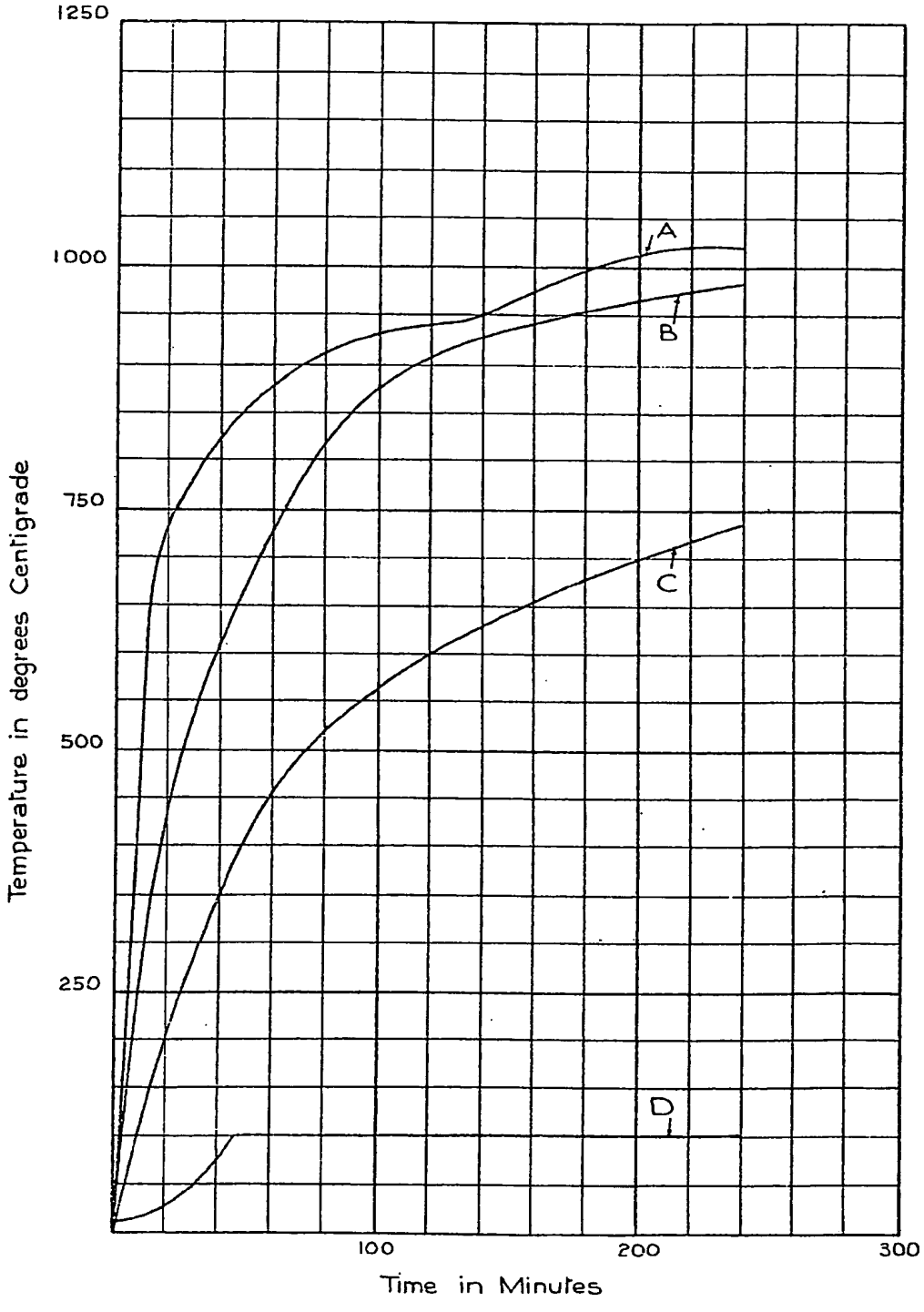

FIG. 3.

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2 SHEETS

SHEET 1

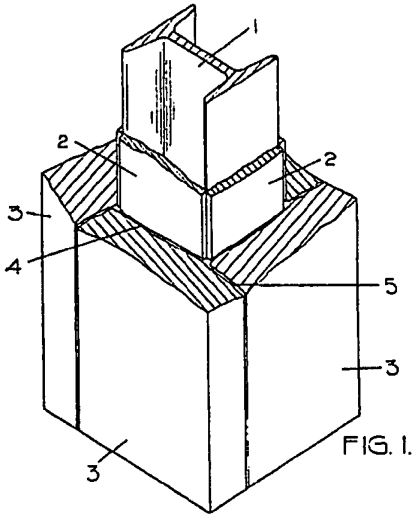

FIG. 1.

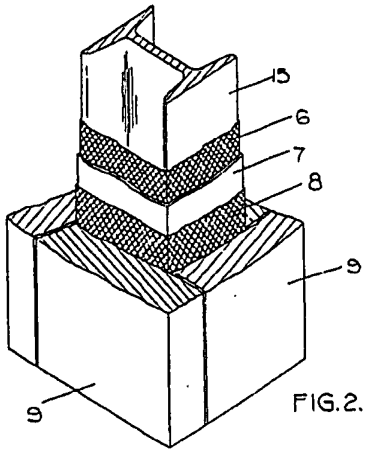

FIG. 2.

SHEET 2

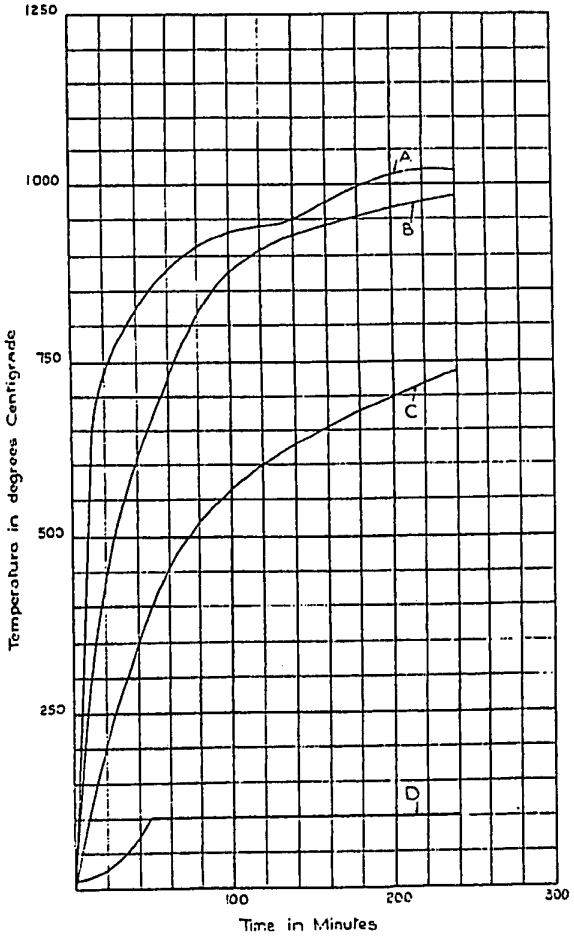

FIG. 3.

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